AIP Conference Proceedings 2006 vol.850, pages 909-910

Spin screening and inverse proximity effect in F/S nanostructures

Khusainov M., Parfenova E., Proshin Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

It is shown that the short-range oscillating spin polarization of conduction electrons around magnetic moment embedded in the superconducting film is screened in aggregate by the long-range antiferromagnetic term, which owes its origin to the Cooper pairing. On this base new exchange model and boundary value problem for the proximity effect in ferromagnet/superconductor (F/S) nanostructures are proposed. In the framework of this model we investigate the possible variants of the mutual accommodation of inhomogeneous superconducting and magnetic order parameters in the F/S nanostructures. The F/S systems of the first type allow only homogeneous ferromagnetic ordering in the F layers, which for the weak exchange fields h < hc coexists with superconductivity in the S layers (FS phase). In the F/S systems of the second type the FS phase exists only for h < hc1. For the exchange fields hc1 < h < hc2 the superconducting layers S induce the nonuniform cryptoferromagnetic modulation (CFS phase) in the spin structure of the F films. This phenomenon can be called as the magnetic (or inverse) proximity effect. The conditions for the coexistence of the inhomogeneous magnetism and superconductivity in the F/S nanostructures EuO/A1, EuO/V, EuS/A1, and LaCaMnO/YBaCuO are investigated and the nontrivial experimental data are interpreted. © 2006 American Institute of Physics.

http://dx.doi.org/10.1063/1.2354999

Keywords

Ferromagnet, Magnetism, Proximity effect, Superconductivity